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M.D.

Inaugural Dissertation.

On.

The morbid effects from drinking cold water

Presented
To the Faculty of the University of Pennsylvania
For the medical degree

By
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of Princeton N.J.
March 5: 1829.

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Remarks on

The morbid effects produced by drinking cold water during a high atmospheric temperature while the body is in a state of exhaustion from previous fatigue.

The disease arising from drinking cold-water during a high thermometrical temperature; though it may be classed among the most painful, during its brief continuance, to which human nature is liable; still appears to have attracted a smaller share of attention than its importance from its rapid and, in many instances, fatal termination and, I had almost added, its frequency would seem to demand. —— This disease is far more frequent than is generally supposed & its frequency and mortality will always be found to bear a pretty ~~xxxxx~~ direct ratio to the heat of ~~xxxx~~ the weather. To show that this affection is not rare or uncommon it will only be necessary to adduce the number of deaths that are reported as having happened from this cause during a given time in some of our cities remembering at the same time that it is a list of the deaths only & not of the whole number of cases of the disease which occurred in those places. In Phil.a during the week commencing the 17th & ending the 23d of July 1825 – while the thermometer ranged between 89° & 94° – 14 deaths from drinking cold water are reported. – In N. York also during the 9 days succeeding the 15th of July 69 cases of sudden death are reported most of which were thought

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to have been caused by drinking cold water. If to arrive at some conclusion relative to the whole number of those affected by this disease we add to the list of deaths known to have been thus caused a portion of those reported "Sudden", "cause unknown" &c and then consider the proportion of recoveries as about triple that of the deaths we shall from such an estimate be forced to allow that instances of the disease are by no means rare during those periods favourable to their occurrance.— In this opinion we shall be farther confirmed by the declaration of one of the Boston physicians that 54 cases of this disease happened in his practice during one week. Nor is it to be inferred that the disease in question is confined to cities alone: it prevails throughout the country in an equal if not greater degree in proportion to the relative number of inhabitants & there is no physician who does not each succeeding year witness more than one case of this kind. From this consideration of its not unfrequent occurrence it is difficult to conceive a reason why it has not oftener been the subject of discussion unless it may be from the short period of the year during which it can happen & the worthlessness of the larger portion of those who suffer from its effects.——

In entering upon the consideration of this subjt we are met upon the very threshold by the hard contested question relative to the stimulant or sedative nature of the action of Cold upon the human system.— To wield this subject in such a manner as to arrive at conclusions which should prove alike unobjectionable & satisfactory to the minds of all would require the talents of an intellectual

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Hercules). Whether a master spirit shall ever arise to grasp the question in all its bearings, to dispipate the obscurity & unravel the intricacies in which the debatants have enveloped it and to unite all in the same opinion remains for time to determine. Each party will perhaps long continue to entertain the opinion it has embraced and considered itself as fully out by the facts & reasoning which can be adduced in support of that opinion. Not considering any analysis of the much that has been written on the Stimulant or Sedative properties of Cold as calculated in any way to elucidate the disease now to be discussed it will be passed over in silence. Yet in passing it may not be amiss to notice one argument which has been adduced in favour of the Sedative nature of cold. — The heat of the body generated by respiration can scarcely be regarded as accurately fixed beyond all variation for though 98° is generally acknowledged as the standard of heat as regards man yet a difference of some few degrees is to be allowed for the difference of age temperament & even sex as recently noticed by Edwards & Gentil.
But if some variation in the degree of animal heat is found to exists in different individuals of the same species how much wider is the difference between the many different species embraced by the Zoological catalogue: —yet some degree of heat is alike necessary to all — Calorie or heat; to use the terms synonymously; — is on all hands acknowledged as a stimulant. Heat then may be regarded as the grand stimulus of life which when reduced

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below its normal degree will give rise to disease and a total abstraction of caloric produces certain death. Now it has been said that as cold consists in nothing but the absence or diminution of heat it cannot but be sedative and this reasoning appears very clear. But to this on the other hand it is answered that if this reasoning be correct then "the act of departure or passing out of the heat" must be stimulant since all parts contract as they become cold & contraction can only be effected by stimuli. Yet it may be questioned whether contraction does take place from cold acting upon the irritability of the muscular fibre but whether it is not rather a mere collapse of the part from the diminution of its circulation. At all events the argument in favour of cold as sedative would appear too conclusive to be thus readily set aside.

This disease so frequent in the U. States is scarcely ever heard of from warm climates in other parts of the world yet cases do occasionally occur abroad though it is said that these cases are never so severe as similar cases with us. To account for this difference of frequency it has been suggested by Dr Pascalis that we should have recourse to the precept of Hippocrates to study well the nature of our soil & of our waters. It would appear from what follows this remarks that he only intended it to apply to the city of N. York. — Yet since morbid effects from drinking cold-water are not more common in that city than in other parts of our country where great diversity of soils would be found to exist and since a solution which should apply to one part should equally apply to the whole it will readily be seen that

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any solution based upon peculiarity of soil & arrangements of strata must be found wholly insufficient. Neither can it be caused by any peculiarity of our waters as it was long ago remarked by Dr Rush that pond or beer will produce the same effects under similar circumstances. The more probable solution of this fact will be found in the more common & habitual use of ardent spirits among the labouring class in this than in any other country.

Intemperance while it gives rise to frequent and inordinate desire for cold-draughts at the same time destroys the capacity of the system for enduring fatigue & breaks down that natural resiliency of the various organs by which they would tend to react upon the application of any agent which might threaten their destruction. ——— This disease seldom if ever occurs in any case previous to the 21st year so also females & negroes more especially the latter would seem to enjoy a considerable phase of exemption while the emigrants from Ireland are said, more than any other class of people, to be liable to its attack. And this would appear to yield some support to the opinion just expressed — that habitual intoxication creates an increased susceptibility to this affection since it is well known that females are seldom found given to intoxication and negroes though many of them would be drunkards from inclination yet from causes which need not here be enumerated they are rather infrequently found fixed and habitual drunkards in practice: While the civil part of our community furnish a very large proportion

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of those addicted to habitual intemperance at the same time that their systems from their previous mode of life in their native land are less capable of resisting the inroads of this all-pervading poison. The more sudden changes of temperature from moderate to intense heat to which our climate is subject may also be another cause of our greater liability than other warm climates to this disease since from the suddenness of the change the system is not allowed gradually to ~~adjust~~ itself to the existing temperature.—

That cold-water may produce disease or death several circumstances must concur. The temperature of the atmosphere must be above 80° or 85° of Farenheit while that of the water is below 50° or 45°. The general system must likewise be in a state of debility induced by relaxation from previous long continued exercise & though to this rule there may have occurred exceptions yet an occasional exception should not be permitted to invalidate a general rule. The stomach too, in such cases is generally empty or nearly so & a considerable quantity of the frigid draught is at once taken into it.

It was long since remarked that this species of Cholera derangement was :—caeteris paribus;— much more likely to ensue from drinking a quantity of iced-water than from the same quantity of well-water of equal coldness as indicated by the thermometer. This though acknowledged as a fact was for some time received as such without any accompanying explanation.

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it has arrived at 32° ~~the~~ continues to part with its caloric & loses many degrees of which the thermometer takes no cognizance. Of this the following experiment affords proof - If ice at 32° be added to an equal weight of water at 172°. the ice is melted & the temperature will stand at 32°: but if instead of the ice an equal weight of water at 32° be substituted then the mixture will be found at the mean heat of 102°.

The disease arising from drinking cold water under the circumstances above detailed may be considered under two varieties differing from each other in the extent of the injury done to the stomach.

The first variety is found to exist when a large quantity of very cold or iced water is suddenly ~~swallowed~~ while the body is in that state of susceptibility to the production of its morbid effects which has been noticed. In this case the sudden abstraction of heat from the gastric parietes produces as sudden a paralysis & annihilation of all the ventricular energies & death ensues in a very brief space: while in other instances this paralysis though more partial in degree is scarcely less certain in its final though rather more protracted issue. Nor is this annihilation of vital power confined to the stomach alone: the lungs deriving their nervous supply from the same source become either immediately or by degrees sympathetically affected & respiration at first difficult continues to become more so till it finally ceases. But before

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this has taken place a train of other symptoms will be presented. The blood forsaking the capillaries becomes congested in the larger vessels thus leaving the surface of a deathlike paleness; the pulse is small toward the last interrupted; muscular power is diminished or entirely lost & the patient is incapacitated from moving from the spot where he may have fallen, a cold sweat starts upon the forehead, the pupils dilate and the retina becomes in some degree insensible to light, sometimes involuntary discharges take place from loss of power in the sphincters & death closes the scene in a period varying from a few minutes to an hour or more according as the shock is more or less intense or as the frame is more or less tenacious of its vital principle.

In the second form or variety of the disease the conservatory powers of the system recovering from the effects of the first shock soon rally, reaction & increased irritability ensue. The feeling of uneasiness first perceived in the epigastric region upon the reception of the water into the stomach increasing in intensity is soon converted into acute lancinating pains which are diffused throughout the abdomen & thorax & which finally end in spasmodic contractions of the stomach & abdominal muscles with occasional intervals of ease. Respiration is difficult and the expansion of the thorax in inspiration is productive of pains similar to pleurisy. If no remedial means are used to check

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the progress of the case it proceeds with an aggravation of all the symptoms. In many instances the voluntary muscles generally or partially share in this convulsive disposition thus giving rise to universal or partial Tetanus with the most painful contortions & indescribable agonies. Wild phrenzy now supervenes, the face becomes suffused with the conjunctiva injected & the carotids beat with violence. When the case promises a happy termination these symptoms gradually abate their severity and convalescence begins: but if it verges towards a more critical issue their severity is increased trismus is added to the list and the patient sinks overpowered by the excess of pain or else Apoplexy with asphyxiation terminate his accumulated sufferings.

Such is a condensed view of the two forms of this disease as it has been found most generally to occur but in this as in every other disease the symptoms will be found variously modified as they exist in individual cases. Minutely to note every shade of the disease that has or may occur is not here attempted: it will be deemed sufficient if the grand distinguishing marks which define its course are noted with accuracy.

It would perhaps be difficult to select from the whole nosological chart a single disease which would manifest so decidedly & fully the influence of the stomach over the general system as the one now under consideration. — Though judging a priori we should scarcely be led to

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infer that an article so seemingly innocuous as a glass of cold water could possibly give rise to a train of symptoms so violent and immediately threatening as those which have been detailed yet experience teaches the lesson & to her we are at last indebted for all our information as well on this as on every other subject

Various speculations have been made as to the nature of this singular affection.— To arrive at more definite conclusions it may perhaps be as well briefly to notice the effects of cold upon those parts of the system which are visible & which at the same time that they are open to every day inspection are more likely to give room for correct observation & conclusions.— During the ~~ascendancy~~ of the application of mechanical laws to medical science cold was supposed to be a peculiar & distinct agent consisting of frigorific particles & that it was by imparting these to the body that it produced its effects.— Chemistry by the developement of the laws & effects of heat soon put to flight this doctrine of the positive & distinct nature of cold and substituted in its room that which at present obtains—that is that cold consists in a mere abstraction or an inferior degree of heat: thus acknowledging caloric alone as having a material existence.— The direct effects of cold;—by which is meant the greater or less abstraction of heat;— may be considered as always the same in character only varying in degree— They are a diminution of the—

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the circulating fluid denoted by paleness, of susceptibility known by the common sense numbness, of action denoted by increased rigidity of the part or parts affected - finally all the phenomena of life are found below their healthy condition. - If an extreme degree of cold be applied or, to be more precise; if a great abstraction of heat be effected then the effects of cold are evinced in their highest degree = reaction does not take place, the laws of vitality gradually cease their influence and the physical effects of cold are manifested in their fullest extent and the part is in common parlance said to be frozen. But if the cold applied is not too severe or the system, previous to its application, in a state of too great exhaustion the conservatory power of the system institutes a second series of effects, in opposition to & counteraction of the direct effects of the cold, & there is an increased tendency of the circulating fluid together with an increased return of heat & irritability to the part or parts affected: the direct effects of cold are overcome & disappear. In other words reaction ensues denoted by an accumulation of the circulation & of susceptibility in the part.

The manner in which cold operates on the stomach may be considered as similar to its operation when externally applied but allowance is to be made for the peculiar situation of the stomach, its greater susceptibility & more powerful influence over the general system. If a great degree of cold be taken into the stomach through the medium

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of water; the system at the same time being in that state of exhaustion favourable to the production of the greatest degree of its effects; then it produces its direct effects & a total or more partial state of atony or paralysis of that organ is the consequence, no reaction supervenes & all those symptoms which constitute the first variety of this disease soon follow. It is in cases of death in this form of the disease that a state of things is observed similar to that which takes place in death from a sudden & violent blow upon the epigastrium & also in death from lightning — in each case the blood is found in an uncoagulated state; the muscles never stiffen & the putrefactive process speedily commences. —— But again if a less intense degree of cold is received or even an equal or greater degree acting upon a lesser development in the nervous tissue of the stomach, or if the system be in a state less suited to the production of its morbid effects or better suited to causing then these causes variously modified give rise to a reaction which may be immediate or more protracted in its occurrence. Reaction having taken place a greater or less degree of febrile excitement is produced in the stomach denoted by the incessant desire for cooling drinks which is at this period manifested

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the affected muscles which are thereby excited into morbid contractions. So in these cases the sensibility of the muscular fasciculi of the stomach being preternaturally increased are excited into contractions producing a Tetanus of the stomach which state is also sympathetically produced in the abdominal muscles; in those of the side of the head constituting Trismus & sometimes the muscles of voluntary motion generally are thrown into action. —— This state of things, mutatis mutandis is not altogether dissimilar to the disease mentioned by Dr Rush (Med. Obs. & Enq. vol 1. pg. 190) as occurring in the W. Indies & called by the French physicians "Crampe seche" or Tetanus of the bowels - but in its the primary action of the cold is upon some of the external muscles exciting Tetanus in them which Tetanic state is extended to the bowels by reversed sympathy. —— —— Broussais in his work on Physiology holds the following language. "If a viscus be inflamed somewhat intensely it stimulates the brain with inconceivable energy, - it assumes absolute controul over the centre of perception & volition. It is under this head, he adds; that we are to class convulsions occurring in individuals affected with Epilepsy, Hysteria, Apoplexy, Tetanus &c - Here there would seem to be the rationale of the origin of the spasms with which the stomach is affected in the second form or variety of this disease from cold water. The cold water produces at first a subsidence

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of vital action by the rapid abstraction of that which its produces: — reaction speedily ensues, — irritability is increased & acute inflammation at once developed which inflammation; according to the authority just cited gives rise to the Tetanus which follows —

Autopsic examination — in those cases of sudden death which take place in the first form of the disease shows the larger vessels engorged & the pulmonary apparatus in some degree similarly affected while the stomach itself bears no traces of inflammation.

In the second form of the disease when death has taken place from the violence of the convulsive efforts a different state of things has been found to exist. Here dissection more generally presents the mucous coat of the stomach variously inflamed sometimes over its whole surface at others only in spots of a stellated or radiated appearance. The encephalic system shares in the derangement, the vessels of the pia mater are highly injected & the ventricles are often found completely filled with serum. — — Such are the appearances which from the division of the disease which has been laid down & the views which have been presented of the nature of its two varieties, we should be led a priori to expect. But the stomach has occasionally been found in cases of death from the second variety to give more of that evidence of inflammation having existed which should be present if such inflammation had previously existed there. Is it therefore to be granted that no inflammation

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has existed? Do we not know that, under similar circumstances, — like causes produce like effects? And the reason that these effects are not in these instances evinced upon examination is perhaps to be sought for in the changes that take place during life's last parting struggles. Then the blood recedes from the previously congested capillaries thus withdrawing the most prominent evidence of the inflammation that has existed & presenting an appearance very different from what would have been discovered could the parts have been examined during the continuance of life. — As to the Diagnosis little need be said. The diseases with which it might be confounded; were the circumstances of the case unknown; are so few: the distinctive features of the disease are so clearly defined & the line of demarkation so plainly drawn as to leave but little room for doubt. From Apoplexy it may be distinguished by the general loss of all the voluntary motions, florid suffusion of the countenance, the highly injected state of the conjunctiva, frothing at the mouth & stertorous breathing: by the absence of these and all the other symptoms that distinguish the apoplectic state.

From Insolation or "Coup de soleil" it differs in the absence of that throbbing of the head, nausea & vomiting which distinguish that disease. — This affection may be considered as somewhat similar to that state which is brought about by poisons taken into the stomach but there are so many points of

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The Treatment must be different in two varieties of the disease. The First Variety as previously described is when the system is depressed to such an extent as to show no signs of reaction. In the severest cases of this kind death is so immediate as to leave little time for the employment of remedies. It is in these cases of sudden death that Dr. Rush has advised resorting to the immediate use of those remedies "which have been so successfully employed in recovering persons supposed to be dead from drowning." Such means might indeed be used & perhaps ought always to be tried but it will admit of a doubt whether any thing can prove of the slightest avail under such circumstances. — But all cases of this form are not thus rapid in their course though sufficiently so to call for the most unremitted and assiduous attention on the part of the physician. — — — The principle indication here is to arouse the system from its state of prostration & endeavour by every means in our power to bring about reaction: it is only by effecting this that we can expect to prevent speedy dissolution. — Of all the remedial means which can at this period be used the warm bath; if it can be procured; will be found of most especial advantage. It brings back the circulation from the large trunks to the capillaries which

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had previously forsaken, relieves the congestion of the internal organs and restores warmth to the surface. But in a majority of cases it would be impossible to procure the warm bath upon the spur of the moment & from the urgency of the case delay would be certain death recourse is to be had to the other means which are conducive to the same end. A foot bath can very generally be procured or if not hot applications of some kind be made to the feet & friction be kept up on the extremities with heated flannel alone or with such rubefacient applications as may be most readily procured as warm-brandy or mustard or spts. ammoniae or capsicum and if nothing else can be had hot ashes may be used. - At the same time we may; as has been advised by Dr Cussin; apply "a bladder filled with water heated to 110.° or 115.° to the epigastrium" & give internally a - tea-cup full of water as hot as can be drank this to be followed by some of the diffusible stimuli either the Ammonia or Brandy or Ether - repeating every 10 or 15 minutes. If called immediately in these cases it would not be amiss as a first step to evacuate the stomach by means of the stomach pump. If the pain in the stomach is severe; which it rarely is in this variety until reaction supervenes; it will be proper to commence the use of Laudanum so highly recommended by professor Rush Bythree and similar means reaction will by degrees be established

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and every untoward symptom disappear or else it will change its stamp gradually merging into and presenting all the symptoms which have been laid down as marking the second or acute variety of the affection. — But the acute variety is not generally thus brought on but in the larger proportion of instances is the original form of the attack or; if not properly entitled to the appellation of original; is so soon developed in that form as scarcely to give any evidence of preceding depression = the reaction having commenced almost immediately after the chilly draught was swallowed —

In the Treatment of this second form it will be proper to notice whether the reaction is partial or general that is whether the stomach alone has rallied from the injury it had sustained while the rest of the system still continues depressed forming a case of what has been called Febris sine Febre: Or whether the general system has likewise reacted thus giving rise to general febrile excitement. If the former state exists then the external means of exciting reaction which were mentioned in the treatment of the first variety are to be continued here at the same time that we call in the aid of those remedies calculated to relieve the painful spasms which exist in the stomach. — — Emetics have been advised by one of the Boston physicians & also by Dr Pascalis of N. York who directs. —

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-ij or viii grs of Tart. Ant. to be given in solution and adds "it counteracts the cramp by producing another sort of action in the stomach & producing a salutary discharge of the offensive contents" – In a paper on the morbid effects of cold water by Dr W. C. Brewster published in the IIth Vol. of the Phila. Med. & Phys. Journal speaking of emetics he holds the following language. "This practice is contrary to all my ideas of the disease; and if it could act beneficially at all, it must be in the commencement & then only with the view of evacuating the offending cause". – So much for medical testimony – Dr Pascalis advises them as one who seems to be appriziated of their value from experience Dr Brewster speaks as though he had never put their utility to the test: which ought to be received as the best authority?

V. Section is at this period a remedy of no ordinary importance and that too whether the excitement be of the general or local kind the only difference is that in the latter case the blood must be abstracted with more circumspection watching the effect produced upon the pulse which will commonly be found to become more natural as the bleeding proceeds. In general free bleeding is preferable: ℥xx. or xxx may be taken on the first bleeding & the operation repeated if pain is not alleviated. Free depletion by the lancet is highly recommended as well by Dr Brewster as by Drs Watts & Pascalis of N. York though it is not

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extolled by Dr Rush who advises Laudinum as "the only certain remedy". It is directed to be given in large and repeated doses suiting the quantity to the urgency of the case. — That Laudinum when given with a proper degree of judgement is indeed a most powerful and efficacious remedy in these cases is granted by all; but that under opposite circumstances its is capable of proving equally injurious is no less true. It doubtless never proved injurious in the hands of so great and judicious a practitioner as Dr Rush but perhaps as much could not be said of many who have followed in his steps in the use of this remedy. — Laudinum is beneficial by calming the irritation and allaying or quieting the pain and spasms of the stomach but if continued in large doses its also by debilitating the capillary circulation has a tendency to increase the engorged state of the large vessels and favouring the Apoplectic inclination which has been observed to exists in these cases when their violence is beginning to subside. From such reasons Dr Pascalis disapproves of the "continued use of Laudinum in large doses" till pain is quieted & Dr Watts Lichfield thinks many have died from the extravagant use of this popular remedy. — — On such grounds its would perhaps be advisable after having given a few free doses to diminish the quantity & give its with some of the diffusible stimuli. And this is the more proper

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since Tetanus from this cause is not so obstinate as from other causes and therefore will neither require nor sanction such full & repeated doses as would be proper in Tetanus from wounds. But there may be some choice as to the article of this class which may be used with or substituted for the Laudanum. Such of these I would venture; from the result of a case in which fell under my observation; to suggest the opts of Turpentine as peculiarly worthy of attention. The case was one of considerable severity but was happily relieved by the use of the warm bath, a mustard plaster to the region of the stomach & the internal use of the Turpentine. It was given quite warm in doses of two tea spoonfull repeated in 10 minutes till two doses had been taken & then the dose was diminished one half: each dose was followed by an equal quantity of Ether. — Sinapisms over the stomach are also found beneficial in relieving the pain & spasm of that organ. Blisters has been used but should a more active and speedy revulsory be deemed requisite it will be found in the Nitric acid, diluted two parts of the acid to one of water spread over the region of the stomach with a feather & its application continued till smart pain is felt when it is to be neutralized with the Carb. of potash. By the continued & judicious use of such means we may generally expect to quiet the irritation of the stomach & calm the violence of those

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symptoms to which it has given rise. But we are not now as it too frequently the case to consider all further attention unnecessary. Nothing is more common than for such cases to be followed by a fever of greater or less severity often with great determination of blood to the head. To prevent this it is always better to direct a purgative to open the bowels freely. For this purpose calomel is to be preferred more particularly on account of its effects upon the hepatic system which is often, as was observed by Dr Rush, rendered liable to inflammation or obstructions after an attack of this kind. If the fever has come on V.S. is again to be resorted to graduating the quantity to be taken according to the violence of the febrile symptoms. To protect the brain when a preternatural determination to it exists cups & leeches followed by cold applications to the head & sinapisms to the feet will be proper. If this determination has been produced or aggravated by the previous free use of laudanum an emetic may be given. A combination of Tart. Ant. & Ipecac. has this advantage over any other that while it is certain in its operation the Ipecac. is known to possess the faculty of lessening the narcotic powers of opium & thus assuming to itself somewhat of the character of an antidote. Having thus brought the case to a close all that remains for us is to direct a restricted diet for some days when the patient may return to his ordinary mode of life. Chronic Hepatitis & ulcers of the stomach may follow: the first requires no peculiarity of treatment and for the latter little else than a palliative course can be pursued. – Finis –

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